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A MEMOIR *of the* MINES *of* GLAN, *the* ROYALTY *of* RICHARD MARTIN, *Eſq.* *By Monſieur* SUBRINE, *Engineer to the King of France.*

THE territory of Oughterard is covered to the eaſt by a calcareous ſtone of a blueiſh colour, ſhelly and fœtid, diſpoſed in layers parallel to the ſurface, and ſuſceptible of a very beautiful poliſh. To the weſt it is covered by a roſe-coloured granite, which however varies ſometimes to a green, the layers of which are moſtly perpendicular to the horizon, and are eaſily decompoſed by the air. To the ſouth it is bounded by the mountains of Mahiramore, the ſummit of which is compoſed of many conſiderable layers of quartz of a very white colour: but the baſe of the mountains is formed of alternate layers of very hard ſlate, and is a ſort of quartz more or leſs denſe. To the north it is bounded by the mountains of Glan, which are entirely compoſed of ſlate, and in which the mines, that make the principal object of theſe obſervations, are found. Read, June 1800.

THE reſpective ſituations of theſe different ſubſtances are ſingularly perſpicuous at the bridge of Oughterard. The caſcade which the river forms in that place, ſeparates the granite from the calcareous country. The precipitate motion of the torrent has ſtripped and dug up the ſoil to ſuch a degree, as to expoſe each layer or ſtratum of the rock, and ſhew them arranged in a ſymmetrical order, ſeldom to be met with in the irregularities of nature. The grotto which has been conſtructed near that caſcade, is cut into the very ſpace that divides theſe two ſyſtems. Here one may ſee three or four beds of ſlate, which are laid immediately over the granite, and which are covered over with calcareous layers, perfectly parallel to them. Thus we learn the order in which the operations of nature were performed. By this ſort of obſervation we are taught to know that the granite was the ground-work of the globe; that the ſlate was afterwards formed and laid over it; and that finally the calcareous ſtone, the moſt modern of all, was laid over the latter. We muſt here remark, that the calcareous ſtone we are now talking of, is that wherein one meets an infinity of ſhells. As to that ſpecies of it which is abſolutely pure, without the apparent remains of ſea-animals, ſuch as are to be ſeen in the mountains of Glan, and which are alſo to be ſeen in the very high mountains of the Alps, it is not as yet decided whether we are to conſider thoſe as contemporary to the granite or to the ſlate, or whether their origin be not of the ſame date with the preceding claſs. In order to diſtinguiſh between thoſe two ſpecies of calcareous ſtone, it will be ſufficient to call the firſt the ſhelly calcareous, and the ſecond the pure calcareous. The ſhelly calcareous ſtone, though alway laid on the ſlate, is not the only ſtone which occupies that place; for we ſee that the lower part of the mountains, to the ſouth of Oughterard, exhibits alternate layers of quartz and ſlate, and that their ſummits conſiſt entirely of quartz. The ſame obſervation is to be made on St. Etienne en forez in France. On the ſide of Mount Bilat, a heap of ſlate is to be ſeen, called Roche Coupée, which riſes to the elevation of from 60 to 80 feet on the ſlaty top of the mountain, and exhibits very diſtinct beds like thoſe of Mahiramore. The black mountains in lower Brittany contain ſuch beds of quartz as form in themſelves mountains over the ſlate. Mr. Patrine, a french naturaliſt, who went to ſee the mines of Siberia, aſſures us that he has ſeen ſome exactly like them in the north.

The mountains which ſurround the bay of Dublin on the north are very intereſting; for upon examination they are found to conſiſt of ſlate, in which conſiderable beds of quartz predominate, at one time very pure, and at other times more or leſs argillaceous, but generally like what the French mineralogiſts call petroſilex. The mountains bordering the ſea on the coaſt of Holyhead, facing Dublin, are abſolutely of the ſame nature with thoſe laſt mentioned; but as it is not our object to compoſe a theory on this ſubject, for which work indeed it does not appear that any naturaliſt has hitherto collected ſufficient materials, and as we would conſider it raſhneſs in us to attempt ſuch an undertaking, conſidering the ſhort ſpace of time we had to inveſtigate matters, we will confine ourſelves to the following obſervations:

1ſt. THE granite that forms the ſouth ſide of the mountains of Glan, and extends acroſs the river of Oughterard as far as the foot of Mahiramore, does not ſeem to be covered or interrupted any where with any other ſubſtance.

2d. IT is not interſected by any perceptible vein; but one may remark, about two hundred paces above the bridge of Oughterard, ſome veins or threads of ſpar, ſo minute as to be almoſt imperceptible, through which ſome cryſtals are interſperſed, whoſe greateſt thickneſs does not exceed half an inch.

3d. THIRTY feet above the river, on the right ſide, there are ſeveral beds of granite, which ſeem to have been fractured by ſome violent force. The ſpace between their numerous ruptures is filled with ſpar, which holds a great quantity of lead.

4th. ALL the country in the neighbourhood of Oughterard abounds with ſcattered lumps of rolled granite, ſome of which are more than ſix feet in diameter. On the top of the mountain there is one that is monſtrous. It is placed on the very ſummit; and it is ſo placed, that though it is nine or ten feet in length, it has not four in the baſe: all thoſe ſtones are of the ſame nature with the fundamental granite of the country.

5th. IMMEDIATELY above the granite towards the grotto of Calypſo three or four beds of ſlate are to be ſeen, the uppermoſt of which is ſo chequered with quartz that it may be eaſily miſtaken for argillaceous clay.

6th. ABOVE theſe beds of ſlate are to be ſeen the calcareous ſhelly beds which are extended down the river towards Loughcorreb, and continue ſome miles on the Galway road.

7th. NEAR Portcarren you can diſcover a very thick vein of calcareous ſpar, in which you will find ſome lead mixed with blackjack. It is impoſſible to bring up any level to it, as it is as low as the lake.

8th. ABOVE the granite, on the ſouth ſide, begins the ſlate mixed with quartz, which forms the foot of the mountain of Mahiramore.

9th. ABOUT half way up the mountain the ſlate is very argillaceous. On the ſouth ſide of Oughterard it contains ſome hardly ceptible veins of lead, and on the oppoſite ſide it appears there is a lead mine, which was once worked, but is now abandoned.

10th. THE entire ſummit of the mountain, for a length of more than a thouſand, and a breadth of about an hundred feet, is of a very pure quartz, very white, and ſometimes of a green yellow, diſpoſed in beds parallel to the ſouth top of the mountain.

11th. AT the foot of the mountains that are to the eaſt of Mahiramore, by the ſide of the Galway road, at the ſpot called Bunnagippane, there are beds of pure calcareous ſtone perpendicular to the horizon, and of a colour almoſt as white as alabaſter. They are penetrated in different directions by veins of calcareous ſpar, the cryſtals of which, having reſiſted the diſſolving of air and water, remain jutting out of the ſurface of thoſe beds, ſo that one may be tempted to endeavour to diſengage them with the hand; but they ſtick ſtrongly and deeply. Theſe veins of calcareous ſpar are throughout very pyritous, and the body of the rocks conceals a good deal of pyritous ſubſtances, cryſtallized into very perceptible cubes.

12th. IN that pure calcareous ſtone of Bunnagippane a load of lead was diſcovered, but without the leaſt appearance of a vein.

13th. IT would be neceſſary to examine whether that pure calcareous ſtone be fixed on the ſlate, as the calcareous ſhelly ſtone is; or whether it be interpoſed in beds, or in veins among the ſlate, as it ſeems to be at Glan; or whether it forms a particular ſyſtem like the granite.

14th. ABOVE the granite to the weſt, at about two miles diſtance from Oughterard, at a place called Lettercraft, there is a ſlate very like that at Glan, in which it was pretended a vein of lead was diſcovered. We have in truth obſerved ſome quartz and argillaceous veins expoſed by the current of the river; but it is impoſſible to ſay any thing more of it at preſent. The pieces of lead which we carried from that ſpot, came from the trials that have formerly been made there.

15th. ON the banks of the river of Oughterard, both in the granite and calcareous parts, one may obſerve an ochreous ſediment or depoſite, often very hard and thick; which made people imagine that it was contiguous to ſome iron mine: the ferruginous taſte of the little fountain which runs above the grotto of Calypſo ſtrengthens this opinion; but as the entire valley traverſed by the river of Oughterard is covered with turf to a very great depth, and as this bog or turf, being decompoſed in the boſom of the marſhes, muſt communicate to the waters which traverſe it perpetually the iron with which the vegetables are more or leſs impregnated, it will not appear ſurprizing that the river of Oughterard, as well as the neighbouring fountains, ſhould be ferruginous. Theſe ochreous ſediments are therefore only the dregs formerly abandoned by the river when it was of a greater extent on the banks, or the immediate products of the decompoſition of the turf, of which the place is now ſtripped.

16th. We have ſaid in ſection ſecond, that the ſouthern ſides of the mountains of Glan were granite. The northern ſides are entirely ſlate. It is in the ſlates that the different veins, commonly known by the name of the mines of Glan, are wrought, or rather undertaken, which we are about to deſcribe in regular ſucceſſion. Firſt, however, allow us to ſay a few words of the country in which they are found.

17th. The mountains of Glan form a chain round Loughcorreb, and dip into it under an angle of about forty degrees. Their ſummit viewed from the lake may be near four hundred feet of perpendicular height. It is in the middle of this height, and in the lower parts of it, that all the mines have been diſcovered.

18th. The ſlate of which they are compoſed is diſpoſed into very regular beds, inclining forty-five degrees at one time in the direction of the mountain; at another time in a quite contrary direction; and as the mountain has different vallies, as you turn from one to another you diſcover the ſlate in all poſſible directions.

19th. THOSE ſlates are at one time tender and leafy—at another time hard and very compact—they are intermixed with beds of quartz, the grain of which reſembles the petroſilex greatly. The hard ſlates have a reſemblance to what the Germans call *hornblende*, and what the French call *ſhorl en roche*, and to what they both call *gwiſs*.

20th. ALL the loads are traverſed in certain places by beds of pure calcareous ſtone, pretty white, which is one time parallel to the horizon, as at the top of the hill, which is between the third and fourth vein; at another time inclined from forty-five degrees, as in the ſhaft put down on the fourth vein.

21ſt. ONE obſerves in thoſe calcareous beds the ſame pyritous and ſparry veins that we have deſcribed in ſection the ſecond.

22d. ONE ſhould determine whether calcareous ſtrata are interpoſed in a parallel manner in the ſlates, or if they cut them like veins, or if they form a particular ſyſtem on the ſides of the ſlates.

23d. At the place you quit the road of Glan to enter into the mountain, and near the lake, there are traces of different trials, but all now abandoned. Some are on veins of lead, others on pyrites, their ſituation being altogether in the plain. The impoſſibility of bringing up levels to them, has, no doubt, occaſioned them to be abandoned. We mention them here only to ſhew how abundant in mines this territory is.

24th. The firſt trial we propoſe to examine is that called Ambroſe's Shaft. It is ſituate about two hundred feet above the lake in a very ſteep place. The vein at this work is almoſt perpendicular to the horizon. The direction is oblique to the mountain, ſo that ſuppoſing it regular and continued, it would extend in a diagonal line from the top of the mountain to the lake. It is about two inches thick. Near Ambroſe's Shaft it forms a ſolid bed of quartz, ſo detached from the mountain as to make one preſume it is ſo throughout the entire of its courſe. The copper ore is found to be contained in the quartz, and mixed with a great quantity of ſulphur. The trial in that place has been abandoned on account of the ſcarcity of the ore, and the hardneſs of the vein.

25th. We conſider that the only way to work to advantage on this vein would be to open a gallery at the lowermoſt part of the mountain in the very vein itſelf, which according to its apparent direction ought neceſſarily to tend thither; and in caſe it could not be diſcovered to open one in ſome degree oblique to the known, and already diſcovered courſe of the vein. Since the compilation of this article we viewed the mountains more particularly, and have found the vein, in coming down in an oblique line as far as the lake traverſes above Ambroſe's Shaft a little valley, remounts to the oppoſite hill, and is finally loſt on the other ſide in the mountain which immediately borders on the lake. The rivulet that flows through the valley has opened the ground ſufficiently to let one ſee the direction of the vein clearly. If a gallery was opened in that place, and proſecuted in the very vein to the right and to the left of the rivulet, one would probably diſcover the vein; but as the rivulet runs down the hill obliquely, and as the courſe of the vein inclines a little in the ſame direction, we believe it would be better to broach the gallery at the very bottom of the valley, taking care however to proſecute it in a direction as much at right angles as poſſible to the courſe of the vein; and when this gallery ſhall reach the courſe another gallery ought then to be driven in the vein itſelf to the right and to the left, and as a greater depth will be reached in proportion to the extent in which the work is proſecuted in this way. By theſe means, we are of opinion, that an effectual trial may be made of this load.

26th. The ſecond trial called the New Vein, which we will call the Cottage Vein, offers more facility than the former, but in return the ore found here is not ſo rich. In order to conceive the matter diſtinctly, one muſt obſerve, that the beds or layers of the mountains are inclined in this place about forty-five degrees, and a vein of quartz, almoſt perpendicular to the horizon, cuts them very regularly between the vein of quartz and the layers of the mountain. On the ſide hanging of theſe a light layer of argillaceous or potter's clay covers the vein and travels with it in its deſcent. This vein has not been broached; but among the beds of ſlate which deſcend at its right, there are two totally pyritous in which a gallery was commenced. Three layers of pyrites are here worked out as copper ore, and really, though they are very ſulphureous, they contain, notwithſtanding, metal ſufficient to ſupport and cheriſh the hopes of a miner.

27th. At an hundred feet perpendicular height above this trial, near an half-finiſhed pavilion called the Cottage, the ſame pyrites are found again in beds of ſlate like thoſe we have juſt ſpoken of. Every motive induces us to believe that they are a continuation of the ſame vein, and we are of opinion that it would be expedient, for the purpoſe of aſcertaining this point, to lay open that ſpot completely, and examine whether or not the vein of quartz, of which we have already ſpoken, is to be found there.

28th. If the vein of quartz is to be found towards the pavilion, then we may be ſure of the regularity and fertility of the load; for the pyrites appearing in abundance at both extremities of the vein, the heart of the mountain, in which it is evident the vein is fed, ought neceſſarily to be very rich.

29th. At all events, the beſt trial that can be made on that place, will be to make an horizontal drift into the mountain, and following the vein of quartz; and in the courſe of this operation, the bed of pyritous ſlate will be cut through. If the vein of quartz ſhall be found to be metallic, this work will turn out advantageouſly; but if it ſhould not be found ſo, one ought then to examine whether the layers of ſlate, which lean againſt it oppoſite to the work, contain any ore.

30th. The trial called the open caſt does not appear to be a regular vein; it is a confuſed heap of blueiſh ſlate of quartz, and a kind of petroſilex, through which pyrites and yellow copper ore are ſpread with great irregularity. That has however, towards its top, an appearance of inclining in the direction of the mountain, that is an angle of about forty-five degrees; and it is covered with a layer of quartz, which at firſt looks like a vein, but which, when accurately examined, is found to be nothing more than a heap joined to the body of the load, and inclined like it in a plane parallel to the ſurface.

31ſt. A SHAFT, called painters ſhaft, was ſunk on this load, about four or five fathoms in depth, which produced ſome ore; but as the ore was miſſed, it was thought the vein was loſt, and in hopes to find it again, they went off on the ſlide bottom of the ſhaft in the direction of the mountain. This project, after it was proſecuted for a fathom or two, was abandoned, for the rock they met was found abſolutely of the ſame nature with the rock at the ſurface of the mountain in the broil of the load.

32d. AFTER this fooliſh trial, they again attacked the ſurface of the mountain, and at the diſtance of twelve ſteps from this ſhaft they opened another ſhaft on the broil of the load, which was dropped, after proſecuting it four and a half fathoms in depth, on account of the water which flowed in abundantly; and to eaſe this water, a little draining level was opened in the ſide of the mountain, which joined the ſhaft at the bottom, where they both reached the quartz. It was intended to proſecute this ſhaft to a greater depth, and it was hoped the water would no longer obſtruct the work, for it was imagined to have been all top water.

33d. IT is eaſy to ſee the error fallen into in the conduct of painter's ſhaft. To find any ore, the miners concerned in this work might well have judged that they had loſt the load, and then ought, inſtead of beginning a ſecond ſhaft and bringing up a level to it, to have made drifts at the bottom of the ſhaft to the north and to the ſouth: to the north until they came out to day, which drift would have ſerved to drain off the water; and to the ſouth until they had penetrated into the mountain far enough to recover the load again.

34th. AND this is ſtill what in our opinion ought to be done; for the ſecond ſhaft and its level, being only in the brol of the load, are perfectly uſeleſs; and the firſt ſhaft which is entirely in the body of the ore, and much deeper than the other, is well circumſtanced for exploring the richneſs of this load; in conſequence of which we think it will be diſcovered.

35th. IF upon this trial it ſhould be found that the ore is ſcarce or poor, it will then be right to continue the ſhaft and make a trial of the load at a greater depth: and for this work it will be neceſſary to provide pumps, called ſupplementary or eſtabliſhed buckets, of a ſufficient ſize to keep the water free.

36th. THIS may not be an improper place to remark, that the probe is an inſtrument often fallacious in the riches of mines, for metallic beds obſerve no regularity, and their gage never being homogeneous, the probe, which reaches only one ſpot, may very well reach the ore, and yet carry back only a very uncertain intelligence. The ſterile layers of the mountain contain ſcattered ſubſtances exactly like thoſe that in the veins may be taken as a gage to the ore, and in the moſt metallic veins one meets with ſome ſtrings of ſlate, or of other rocks, abſolutely of the ſame nature with the mountain: it is evident that the probe, in carrying back with it both the one and the other of thoſe matters, cannot give compleat ſatisfaction.